NGI Related Activities at NLM/NIH

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National Library of Medicine

What is the United States National Library of Medicine?

[Web site URL http://www.nlm.nih.gov]

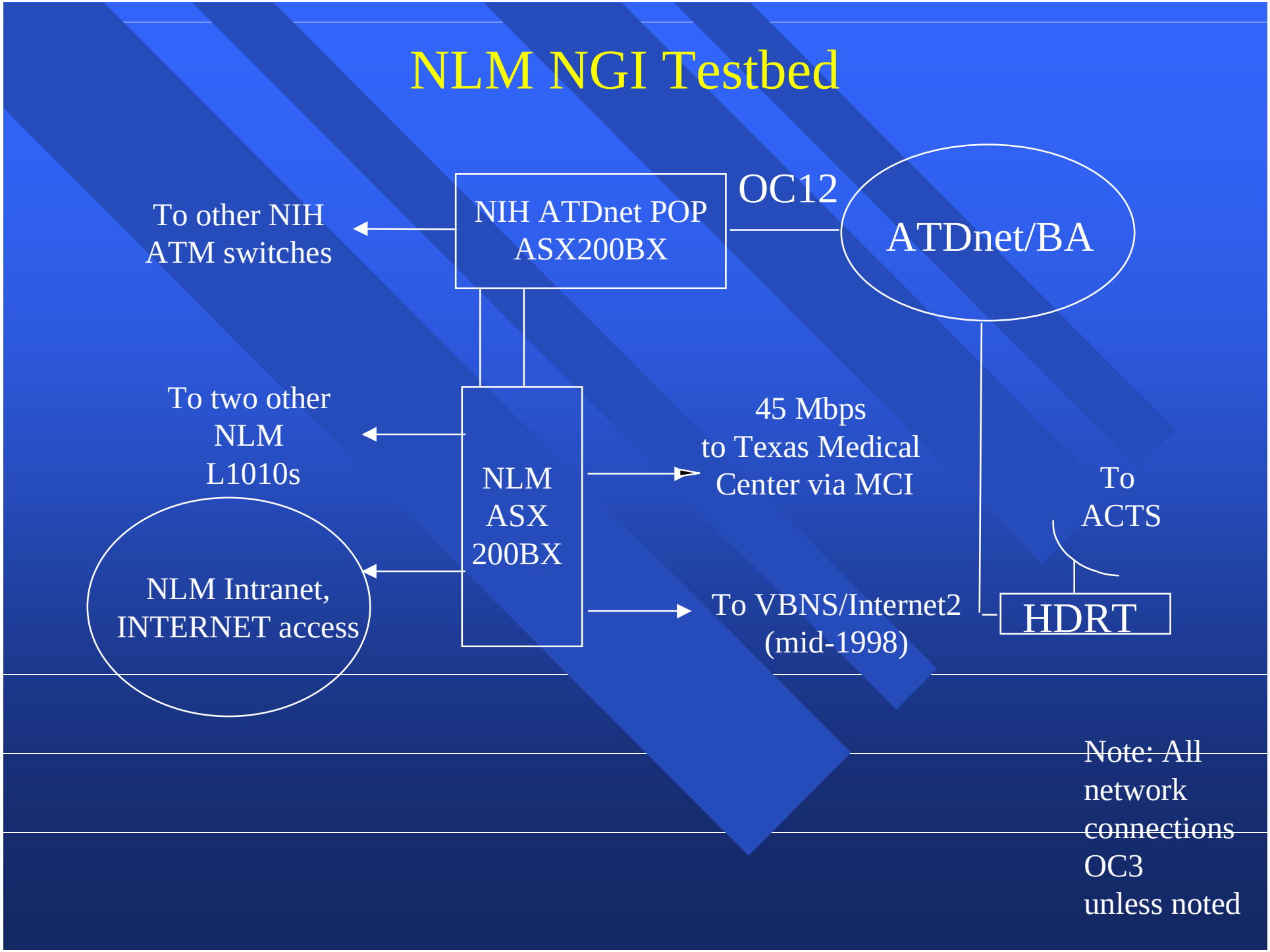
- The worlds largest biomedical library. 5 million items--books, journals, technical reports, manuscripts, microfilms, photographs and images
- Part of the National Institutes of Health
- Programs from medical history to biotechnology

Why is NLM involved with NGI?

- Possession of large image data sets
- Research into biomedical communications and distance health education
- ISTO: Image Storage Transmission and Optimization Project (compression and communications techniques applied to Visible Human data set): *Need faster data transfer*
  - BITA (sub-project): Biomedical transmission over ATM

NLM ATM Research Network Connectivity

- Internet2 member 1997, connectivity mid-1998 via BWI gigapop
- VBNS membership in process, connectivity mid-1998
- NGI funded agency (connection provided via ATDnet currently)
- ATDnet: Advanced Technology Demonstration Network
  - NLM has 2 155 Mbps links into the ATDnet
    - » Via an NIH 622 Mbps link to ATDnet
- MCI technology trial network
  - NLM has a 45 Mbps link into an MCI ATM test network
    - » Texas Medical Center at other end of link, through the Institute for Biosciences and Technology (part of Texas A&M University)


NLM NGI Testbed
To other NIH ATM switches
NIH ATDnet POP ASX200BX
OC12
ATDnet/BA
To two other NLM L1010s
NLM ASX 200BX
45 Mbps to Texas Medical Center via MCI
To ACTS
NLM Intranet, INTERNET access
To VBNS/Internet2 (mid-1998)
HDRT
Note: All network connections OC3 unless noted

Large Image Data sets

- What digitized biomedical images/data sets exist here?
  - Visible Human (MRI, CT, Cryosectioned anatomic color images)
  - NHANES II (spine x-ray images)
  - Future images: NHANES III (hands, knees x-ray images)

Visible Humans

Visible Humans

- Data set representing complete normal adult male and female
- MRI, CT and cryosectioned anatomical images of two cadavers
- Male and female data provided to over 700 licensees
- Male Dataset
  - MRI: axial images of head and neck and longitudinal of rest of body at 4 mm intervals, 256x256x12 bits gray scale
  - CT: Axial scans of entire body at 1 mm intervals at 512x512x12 bits grey scale
  - Anatomical cryosection (ccd scanned): Axial images at *1 mm* intervals at 2048x1216x24 bits color (bulk of dataset)
  - 1871 cross-sections for each mode
  - Complete male set 15 GB

Visible Humans

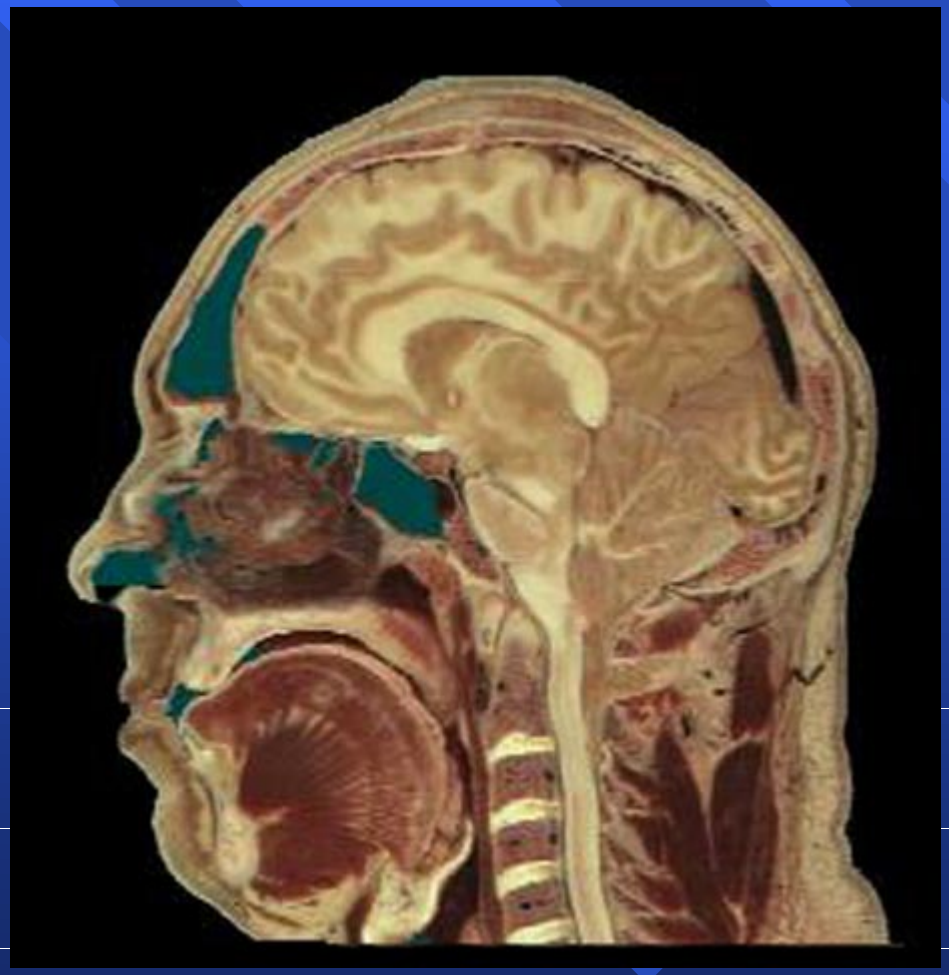
- Female Dataset
  - MRI: axial images of head and neck and longitudinal of rest of body at 4 mm intervals, 256x256x12 bits gray scale
  - CT: Axial scans of entire body at 1 mm intervals at 512x512x12 bits grey scale
  - Anatomical cryosection (ccd scanned) : Axial images at *.33 mm* intervals at 2048x1216x24 bits color as opposed to *1 mm* for male (bulk of dataset)
    - » Result is 5000 cross-sections
  - Complete female set 40 GB

Visible Humans

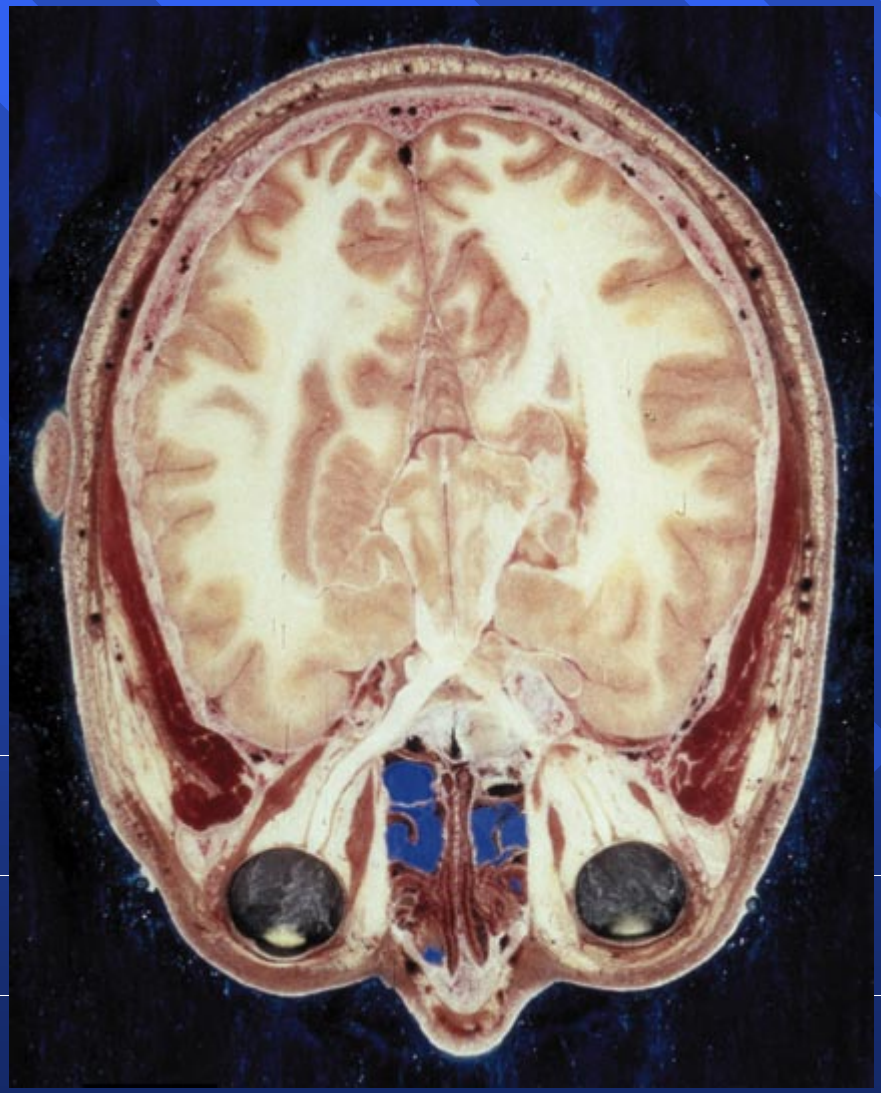
Visible Humans

Visible Humans

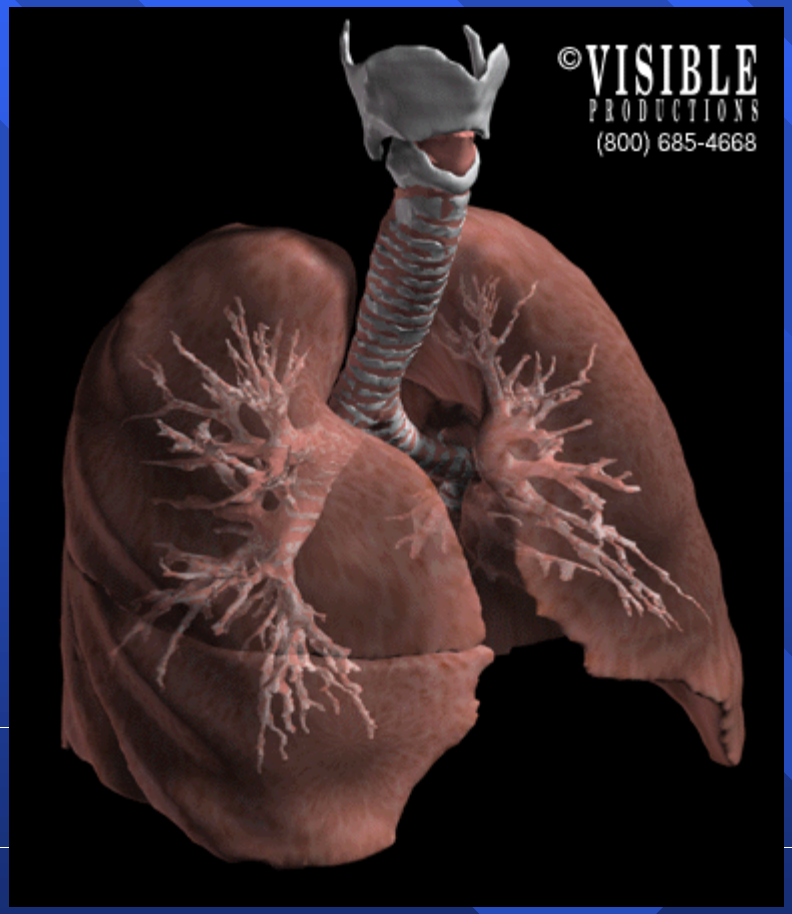
Visible Humans



Visible Humans



Visible Humans



Visible Humans

- *Application viewers*
- Products based on the Visible Human Data Set

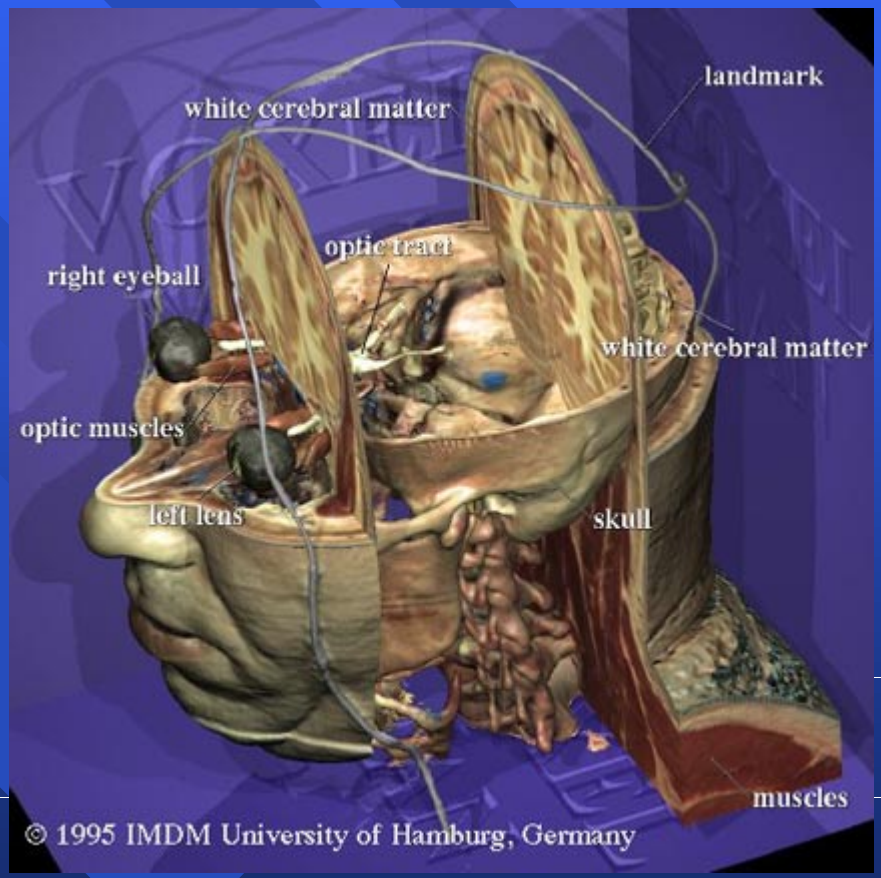
- Applications for viewing images from the Visible Human Data Set
  - The NPAC Visible Human Viewer, developed at Syracuse University, is a Java applet that allows you to extract planar views of the Visible Human male dataset (requires a Java enabled Web client).
  - The Cross Sectional Anatomy viewer from Loyola University (Chicago) Stritch School of Medicine.

Visible Humans

- Application viewers
- *Products based on the Visible Human Data Set*

- Products based on the Visible Human Data Set
  - The Dissectable Human CD-ROM and printed atlases, from Engineering Animation, Inc. and Mosby.
  - VOXEL-MAN interactive 3-D atlas on CD-ROM for Unix workstations done at the Institute of Mathematics and Computer Science in Medicine, University of Hamburg

Visible Humans



Survey Contents

NHANES II	NHANES III
1976-1980	1988-1994
Sampled: 27,801	Sampled: 39,695
Interviewed: 25,286	Interviewed: 33,994
Examined: 20,322	Examined: 30,818
6 mo. - 74 years	2 mo. and older
100's of data variables: age, gender, race, income, education, marital status, height, weight, blood press., glucose, lead, hypertension, phys. exam, questionnaire	apprx. 5000 data variables
	health components included cardiovascular, respiratory, gallstone diseases, diabetes, thyroid function, arthritis & osteoporosis
17,000 cervical/lumbar spine x-rays	10,000 hand/knee x-rays

NHANES II

- Collateral data and x-rays from the 1976-1980 National Health and Nutrition and Examination Survey (NHANES II)
- Gathered by National Center for Health Statistics (NCHS), part of the Centers for Disease Control in Hyattsville, Maryland
- Work done in collaboration with National Institute of Arthritis and Musculoskeletal and Skin Diseases

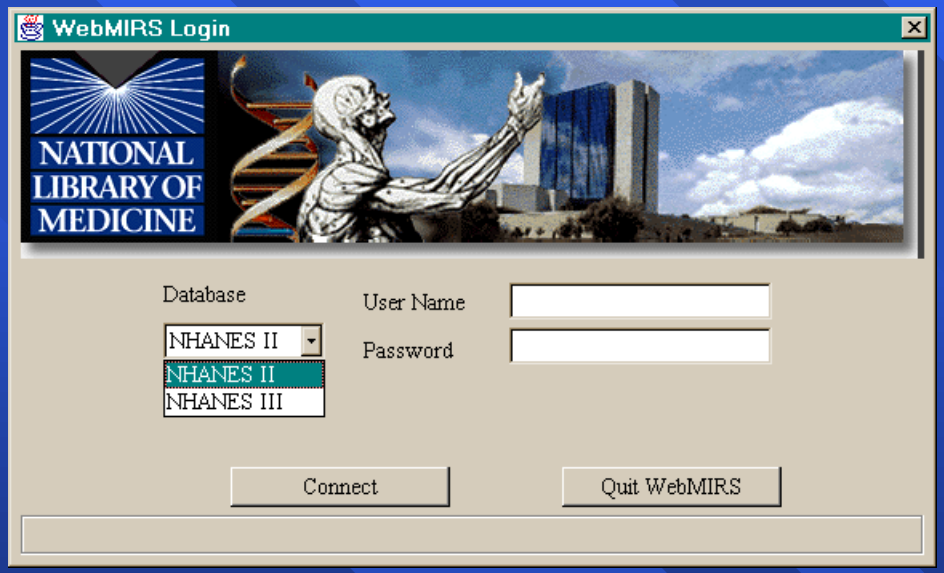
NHANES II

- About 17,000 digitized x-rays of lumbar and cervical regions
- Cross section of United States population
- Lateral views of cervical and lumbar spine for persons age 25-74
- 300 platters total, 100-140 GB data set
- Part of uncompressed image data on 144 5.25” magneto-optical platters in a jukebox
- Digitized using either a Lumisys 100 or 150 laser spot scanner/spot size 150 microns
- Cervical resolution of 1463x1755x12 bits, (5 MB)
- Lumbar resolution of 2048x2487x12 bits, (10 MB)

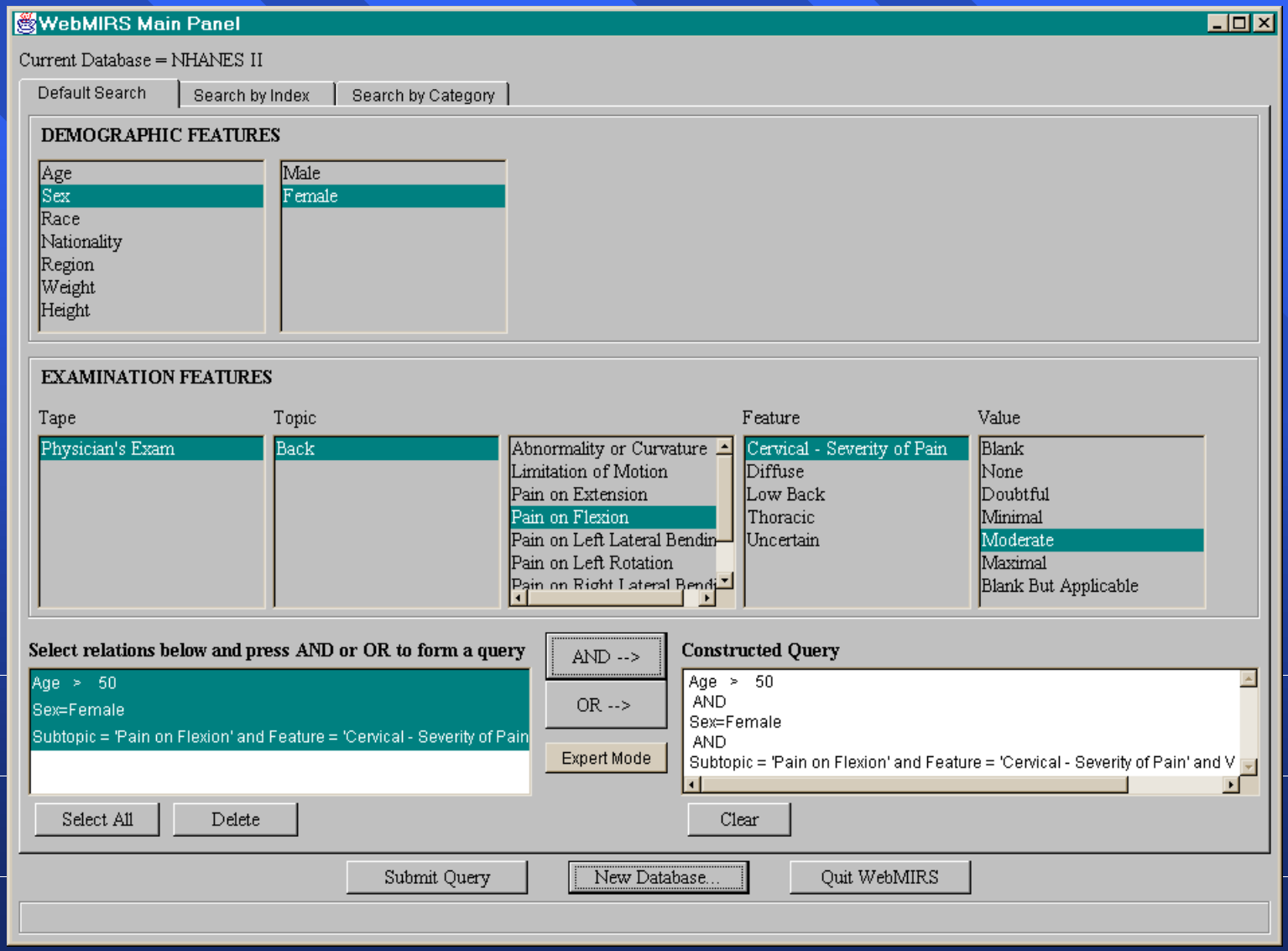
NHANES II and III comparison

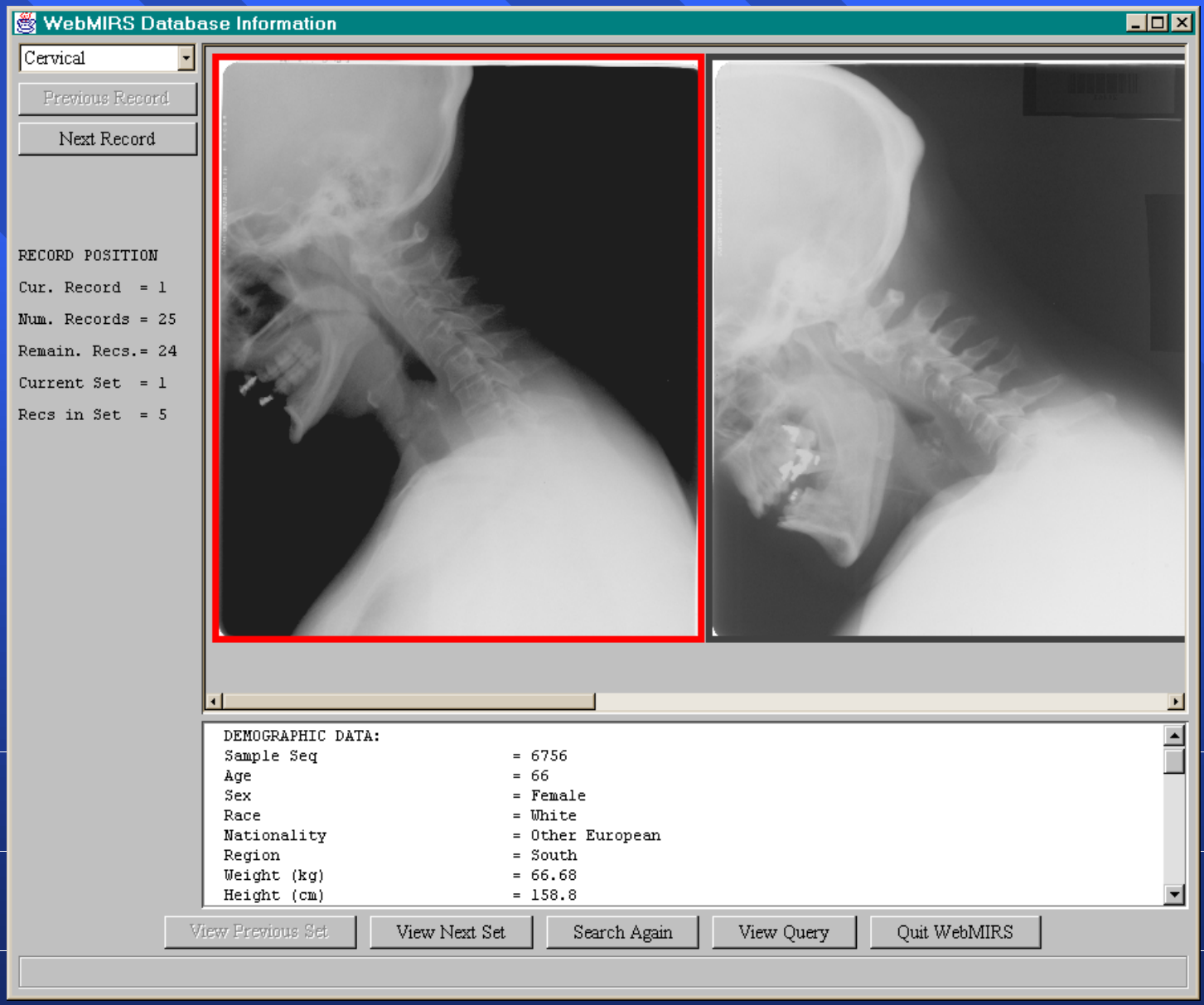
	Type	Num	Lo-res Size	Storage	Hi-res Size	Storage
NHANES II	Cervical spine	10,000	200 KB	2 GB	5 MB	50 GB
	Lumbar spine	7,000	200 KB	1.4 GB	10 MB	70 GB
NHANES III	Hands	5,000	400 KB	2 GB	14 MB	70 GB
	Knees	5,000	400 KB	2 GB	14 MB	70 GB

NHANES multimedia distribution via Browser



WebMIRS Browser interface




WebMIRS Database Information
Cervical
Previous Record
Next Record
RECORD POSITION
Cur. Record = 1
Num. Records = 25
Remain. Recs.= 24
Current Set = 1
Recs in Set = 5
DEMOGRAPHIC DATA:
Sample Seq = 6756
Age = 66
Sex = Female
Race = White
Nationality = Other European
Region = South
Weight (kg) = 66.68
Height (cm) = 158.8
View Previous Set
View Next Set
Search Again
View Query
Quit WebMIRS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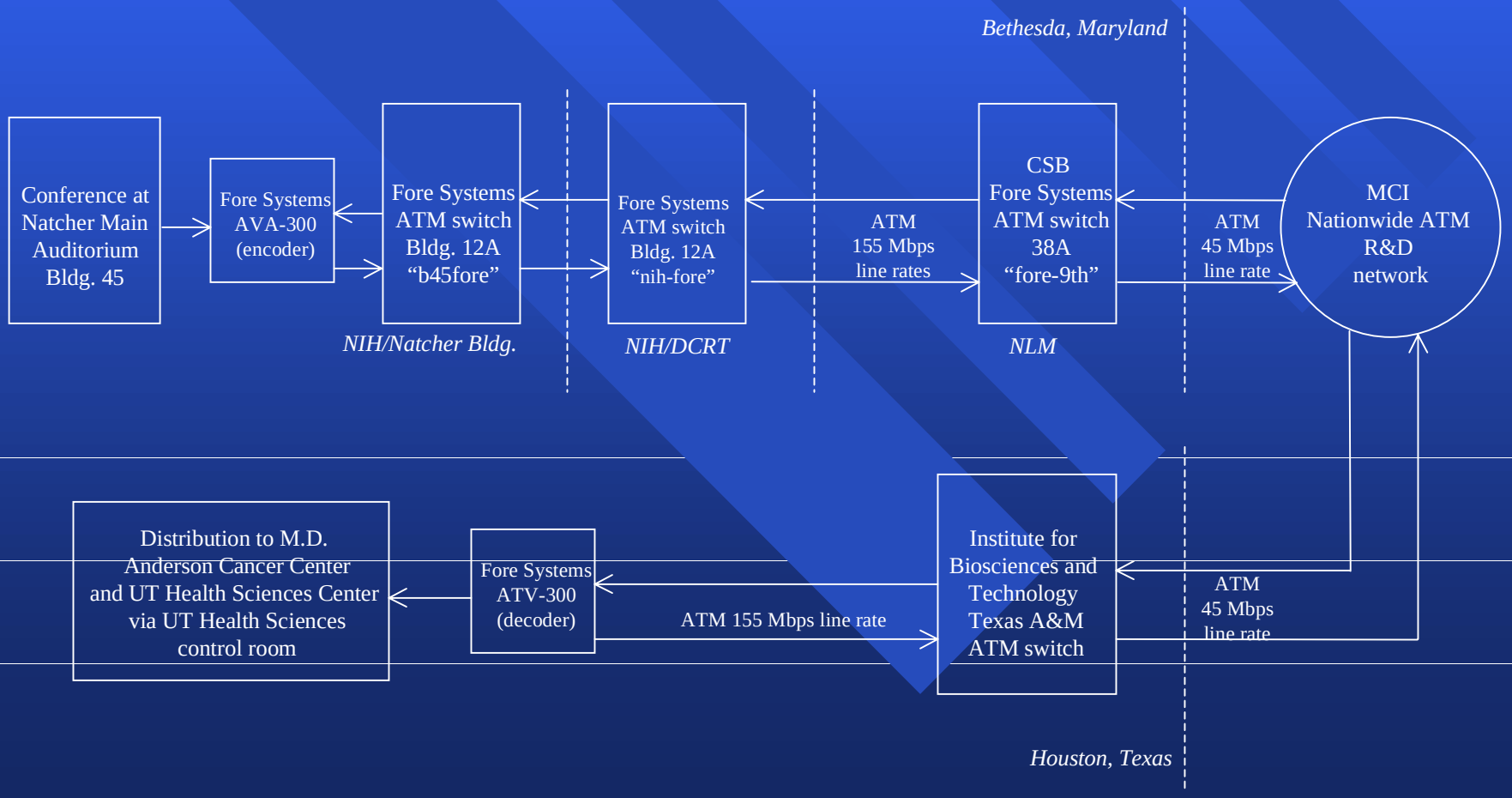
Distance health education

- A series of demonstrations done with Texas A&M University, MD Anderson Cancer Center, Baylor
- Video and audio of NIH located scientific conferences sent via ATM
- BENEFITS
  - Enhanced access to biomedical research data
  - Wider distribution of data (ATM used in the telecommunications system infrastructure)

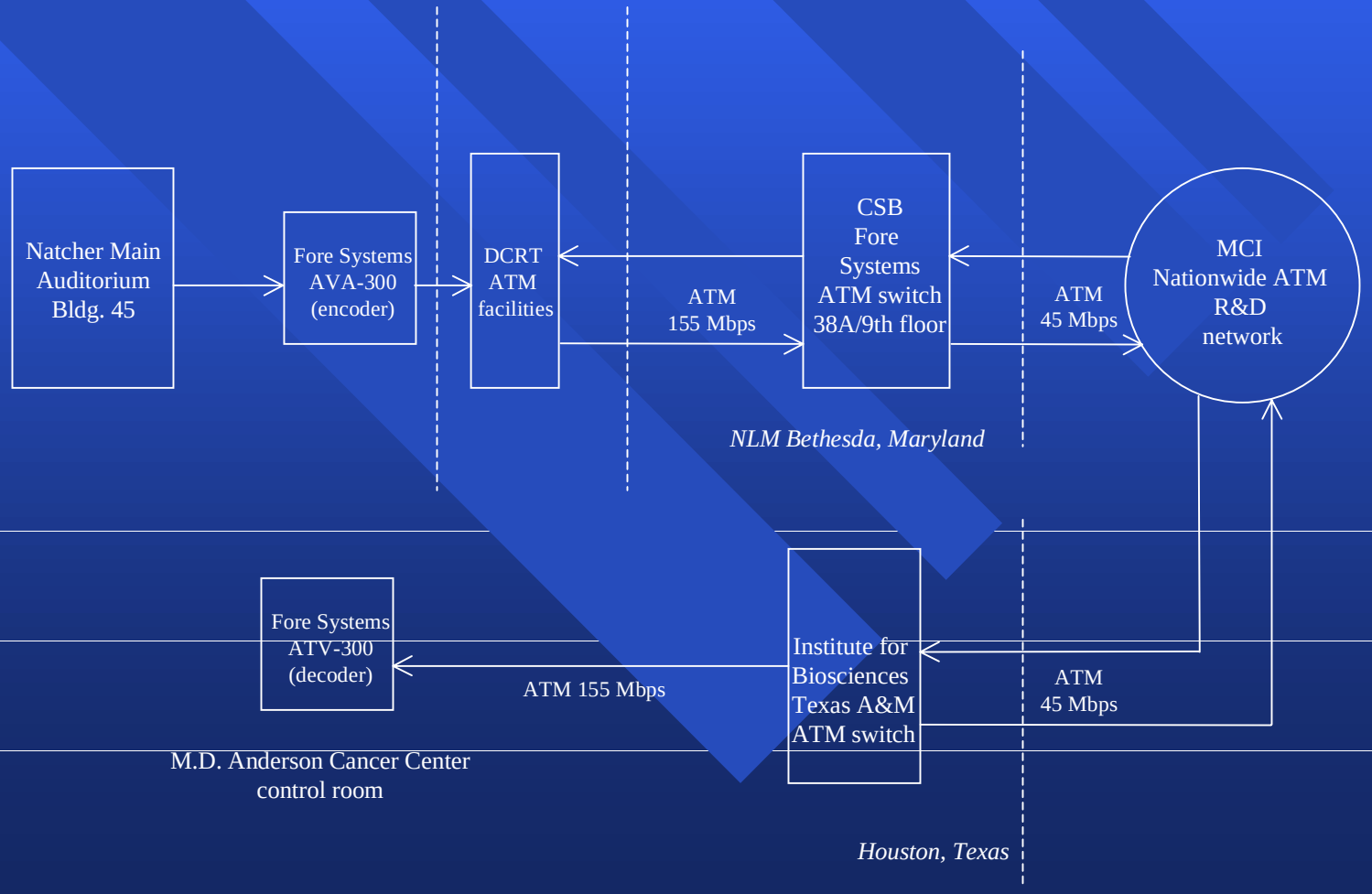
MJPEG Video via ATM Technology Demonstration
NIH's Natcher Auditorium to M.D. Anderson via NLM
January 21-22, 1998

(Sponsored by FDA, NIH, CDC, HRSA
"Developing U.S. Public Health Service Policy in Xenotransplantation")



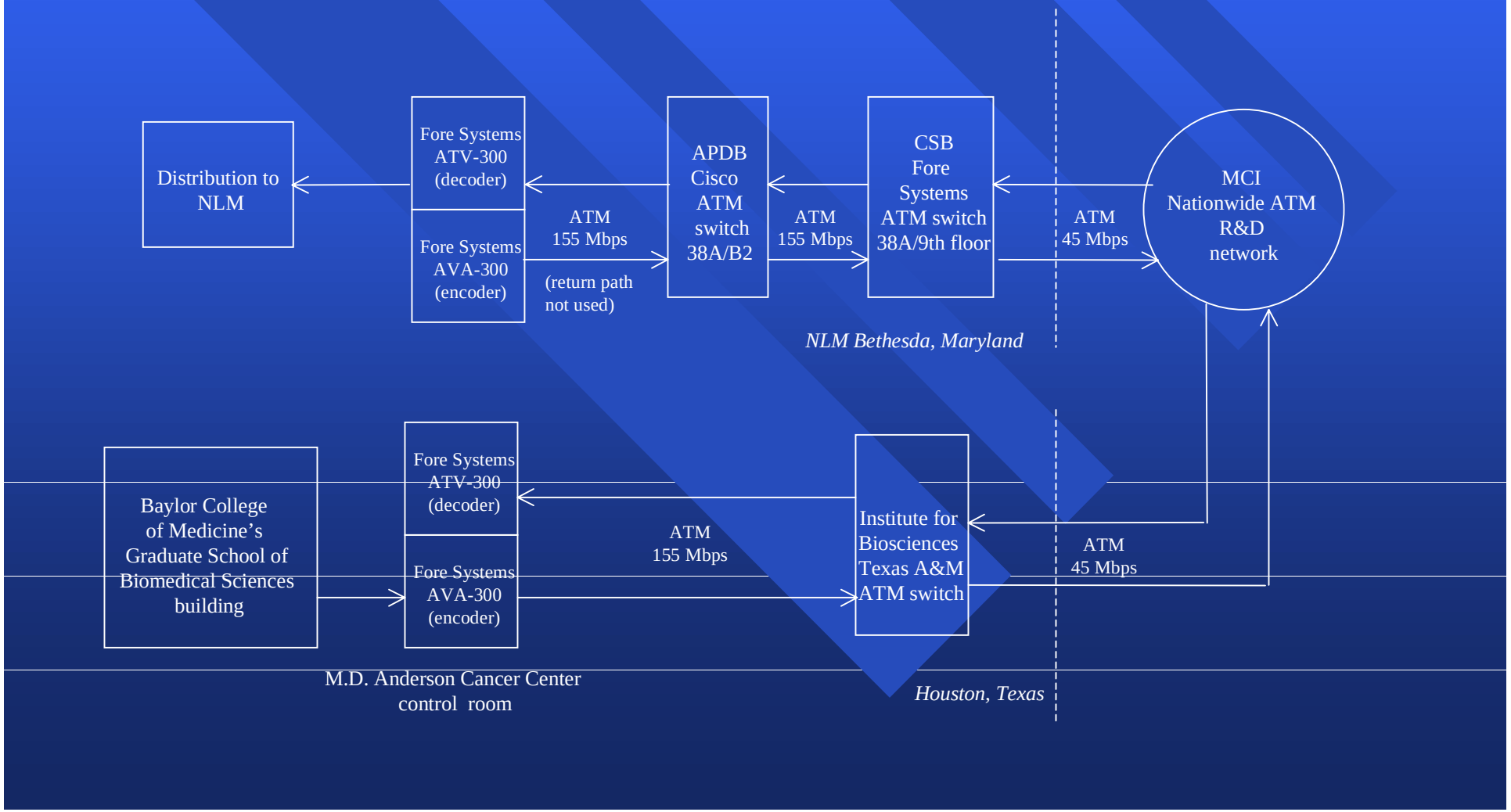
MJPEG Video via ATM Technology Demonstration
NIH's Natcher Auditorium to M.D. Anderson via NLM
July 15-18, 1997

(Sponsored by NIH and FDA,
"Forum 1997: Gene Therapy")



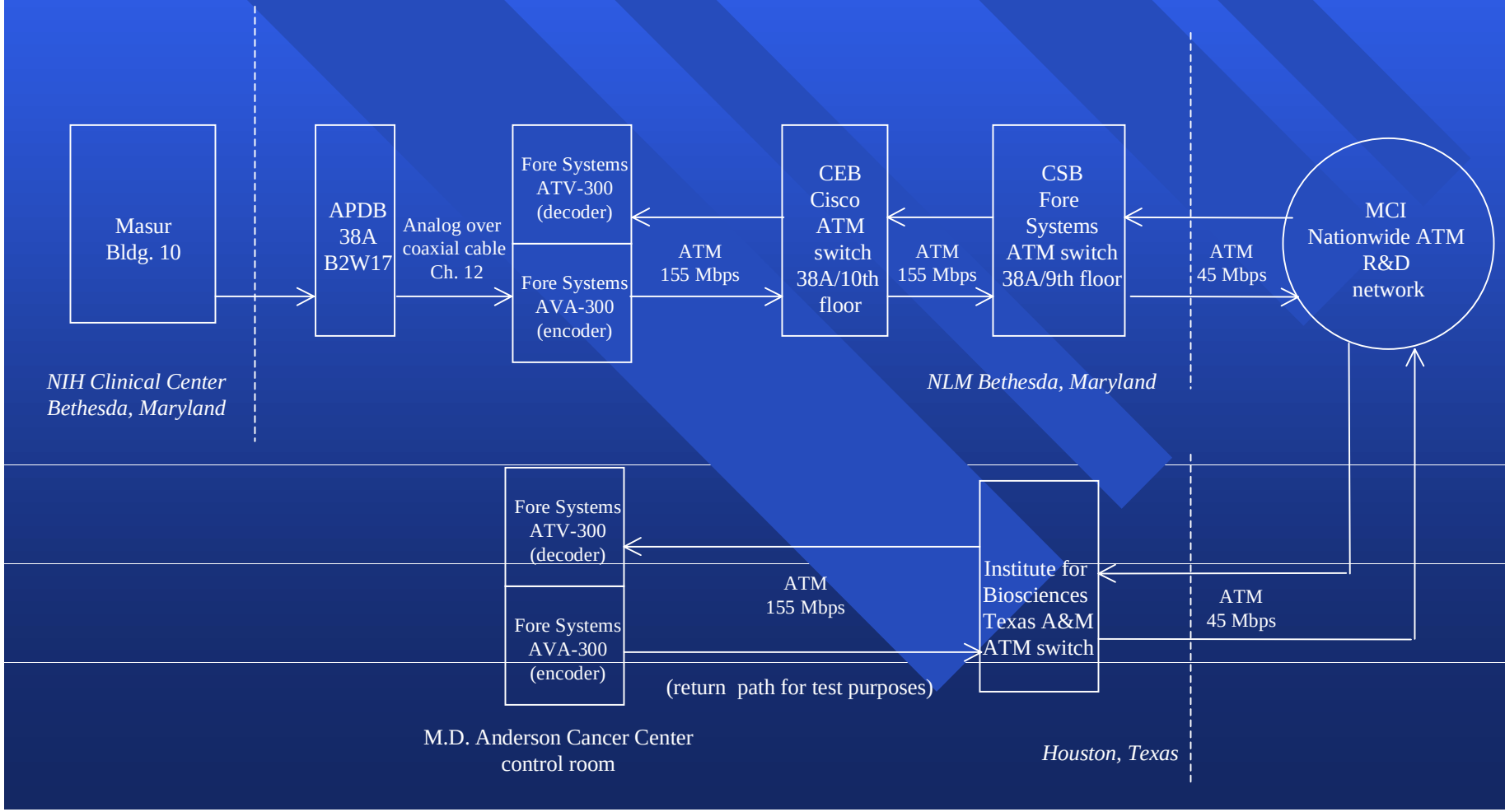
MJPEG Video via ATM Technology Demonstration
Houston Academy of Medicine-Texas Medical Center Library to NLM
June 24, 1997

(Tele-Health Care 1997: A Computers in Health Care Conference)



MJPEG Video via ATM Technology Demonstration
NIH Clinical Center to M.D. Anderson via NLM
June 10-11, 1997

**(General Motors
Cancer Research Foundation
Annual Scientific conference
"Cutaneous Malignancies")**



NGI Benefits

- BENEFITS
  - Enhanced access to biomedical image research data
  - Wider distribution of data (ATM used in the telecommunications system infrastructure)
  - Higher resolution image datasets (larger image files allow for lossless images)
  - Enhances accessibility of multimedia (text and images) databases
  - Faster network access

References

- NLM Dr. George Thoma, thoma@nlm.nih.gov, Rodney Long long@nlm.nih.gov, Dr. Michael Ackerman ackerman@nlm.nih.gov.
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- NIH- http://www.nih.gov
- Garnett, C. NIH Joins Next Generation Internet, Internet2 Development Efforts. The NIH Record http://www.nih.gov/news/NIH-Record/02_24_98/main.htm, February 24, 1998.
- The NGI Program, www.ngi.gov.